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ABSTRACT

The purpose of the Workshop on Graduate Student Attrition was to address key gaps in knowledge and data about the problem of graduate school (doctoral-level) attrition. Participants included representatives of the academic research and graduate education administration communities, along with officials from disciplinary professional societies, The National Science Foundation, and other government scientific agencies. Results of the workshop are presented in sections: (1) The Concern; (2) The Rationale for Attrition Research; (3) Conceptual Issues; (4) Definitional Issues; (4) Timing of Attrition; (5) Institutional Factors; (6) Current Research and Databases; (7) Future Directions for Research; (8) Data Improvements Underway; (9) Changing the Graduate Experience; (10) Stakeholder Uses of Attrition Research; and (11) Caveats about Use of Attrition Data. Appendices contain a list of the workshop speakers, moderators, participants, and planners, and the workshop program. (Author/WRM)

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Summary of Workshop on Graduate Student Attrition

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Division of Science Resources Studies
Directorate for Social, Behavioral and Economic Sciences

National Science Foundation

December 1998

Summary of Workshop on Graduate Student Attrition

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December 1998

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Summary of Workshop on Graduate Student Attrition

The Division of Science Resources Studies (SRS) of the National Science Foundation (NSF) held the Workshop on Graduate School Attrition on September 22, 1997.[1] Participants included representatives of the academic research and graduate education administration communities, along with officials from disciplinary professional societies, NSF, and other government scientific agencies.

The purpose of the workshop was to address key gaps in knowledge and data about the problem of graduate student attrition. Specific gaps to be addressed included knowledge and understanding of the overall extent of doctoral student attrition; factors that influence whether or not students complete their doctoral degrees; the impacts that such decisions have on their future earnings and labor force experiences; and further data that would be needed to assess more confidently the extent, causes, and consequences of graduate student attrition.

The workshop focused on the problem of students who intend to obtain the doctorate rather than the master's as the terminal degree. The greater concern over doctoral student attrition, one speaker noted, is that the students in master's programs differ in a number of respects that may affect attrition rates, such as being more focused on a specific professional career path and having already had experience in the job market.

The Concern

The National Science Foundation (NSF) is concerned with graduate student attrition for a number of reasons cited by NSF officials:

- Doctoral education is costly not only for society and higher education institutions, but also for the student.
- Attrition is especially relevant to NSF's role in supporting students in science and engineering directly through graduate fellowships and traineeships, and indirectly through research assistantships attached to NSF research grants.
- Attrition is relevant to NSF's commitment to increase the participation and success rate of historically underrepresented groups in science and engineering education.

The doctoral student is a precious resource in providing the new discoveries and expert knowledge essential to the nation's future.

The Rationale for Attrition Research

Education policymakers can benefit from more accurate, complete, and detailed information on the extent, causes, and consequences of attrition. As noted in a National Research Council report, attrition rates, along with statistics on degrees conferred and postgraduate plans, are "vital to educators and policymakers" as well as being useful to prospective students in making decisions about graduate studies.[2]

Education policymakers have an immediate interest in reducing the economic costs of attrition to students and their institutions. They can also use attrition research findings for more informed policymaking on a wide range of issues. These include allocation of financial resources to graduate students, increasing participation and success rates of underrepresented groups, preserving the university's role as a resource for new knowledge, innovation and highly trained workers, and meeting increased demands for accountability in performance of individual universities, programs and departments.

For students, accurate information on completion rates can help them make decisions that avoid both economic and psychological impacts that accompany failure to complete degree programs.

[1] This workshop is part of an ongoing series of SRS/Professional Societies workshops and of NSF's Graduate Education Initiative and other activities relating to graduate school education. Some of the other activities are described in this summary under "Future Research Needs" and "Changing the Graduate Experience."

[2] The Path to the Ph.D.: Measuring Graduate Student Attrition in the Sciences and Humanities, National Academy of Sciences, 1997 (Washington, D.C., National Academy Press).

Resource Allocation

Financial aid is generally believed to play an important role in graduate student persistence. A key policy question that arises in addressing attrition is whether student decisions to complete the degree are related to the timing, amount, and type of aid they receive. Unfortunately, such detail on financial resource allocation is extremely difficult to collect for a variety of reasons. Among them are the limitations of university information systems, the multiplicity of sources from which students receive aid (from both within and outside the institution), and inaccurate or incomplete self-reporting by students.

Underrepresented Groups

In order to enhance the participation and success rates of minorities, women, and other underrepresented groups in doctoral education, more data are needed on the context of their graduate school experience. Such data have been obtained from surveys, interviews and focus groups as well as site visits. The questions asked usually relate to such contextual elements as the quality and quantity of faculty mentoring and opportunities to participate in the life of the department.

The Role of Universities in the Knowledge Society

As the 21st Century approaches, many of the new jobs require strong analytical skills and the ability to acquire new knowledge and apply it to novel situations. Persons who are accepted for advanced degrees presumably have demonstrated the potential to perform in these areas. When a student leaves, universities and society lose their considerable investment in that potential. This is true even though some leavers may find a productive niche without obtaining their degree.

Accountability

Pressures for greater accountability in higher education are already occurring at the undergraduate level. Signs of this trend include the following:

- The publication of completion rates by the National College Athletic Association (for student athletes only) and *U.S. News and World Report*.
- A law passed by Congress[1] which mandates the reporting of completion rates for undergraduate degrees.

These and other developments may foreshadow pressures that might extend to graduate education, thus further highlighting the need to prepare now for data collection.

Conceptual Issues

In designing attrition research, researchers face certain conceptual difficulties. The discussion at the workshop brought out various alternative phrases that might be used to describe research that yields data on attrition, such as doctoral student persistence (which implies tracking students through various phases of their graduate education), completion rates (which measure only final outcomes), and retention (which focuses on continuing registration in the original doctoral program or department of choice). None of these, however, is considered to be an exact mirror of attrition, because of the uncertainty surrounding the status of students who leave.

Other issues raised included whether all attrition is necessarily a problem and what would be an acceptable level of attrition.

Is Attrition All Bad?

A frequent comment was that some attrition should be considered inevitable, and therefore not necessarily undesirable. In fact, some viewed a certain degree of attrition as a societal gain rather than a loss. Examples cited are students who transfer to pursue a degree in another field or who leave for work that employs their graduate training. Such cases, by one informal estimate, might account for 20-40 percent of "non-completers." This group should not be included in attrition statistics, since they go on to productive lives elsewhere. In this light, the problem might be viewed as one of converting later attrition to earlier attrition in order to minimize the investment lost from students dropping out at the latter

[1] Higher Education Amendments of 1991: Students Assistance General Provision Act, Sections 668.41, 668.46, and 668.49, known as Student Right-to-Know Campus Security Act. The implementing regulations did not go into effect until the 1995-96 academic year.

stages of their graduate experience. Another view was that attrition represents student adjustment to expectations about future employment and possible surfeit of doctoral students.

The uncertainty about what actually happens to students who leave their original graduate school program was generally seen as highlighting the need for more accurate information on the real extent and context of attrition.

Acceptable Levels of Attrition

Assuming an overall measure of attrition could be arrived at, the workshop participants gave a fairly wide range of rates that would be acceptable, all below 50 percent. One speaker said that if the overall rate was as low as 10 to 15 percent, attrition probably would not be considered a problem. Another said that even if attrition were about 50 percent, that is not as bad as it sounds. Still another felt that 20-40 percent might be "perfectly acceptable."

Given these variations and uncertainties about completion or attrition rates, no consensus emerged on what would be an acceptable overall level of attrition.

Definitional Issues

As a baseline, one presenter defined attrition as that proportion of the entering cohort into a doctoral degree program that does not complete the graduate program undertaken. Immediately, this definition presents problems concerning the two key data points: how to identify the cohort and the proportion who do not complete the program.

At the start of their graduate education, for example, not all students define themselves as doctoral candidates; others define themselves so primarily in order to obtain financial support.

Graduate institutions themselves also differ in their definition of who is and who is not a doctoral candidate. It is even more difficult toward the end of the doctoral pipeline to determine when a student becomes an attrition statistic, most workshop participants agreed. Here again, the "in-and-out" phenomena complicates the task of drawing a line around the universe of noncompleters. With the total process extending as long as 12 years, the task of determining which students remain on a doctoral degree course, let alone those who have definitively dropped out, is formidable. In addition, researchers face the challenge of determining which factors are student-related and which are institutional.

Timing of Attrition

From the standpoint of informing policy, gross completion rates are not considered adequate for measuring attrition, precisely because they do not reveal at what stage students are leaving or whether they have left permanently. Some researchers have, therefore, designed studies that attempt to identify the stages at which attrition occurs and to capture the reason why students quit. One presenter divides those who quit into three time periods: after the first year, the middle stages, and after being advanced to candidacy or the all-but-dissertation (ABD) stage. Some of the factors that may be causing attrition at each stage were:

- After the first year—flaws in selection and graduate school "hazing"
- Middle years—financial and other personal problems which might be mitigated by improved student support or effective monitoring
- ABD attrition—although this stage is believed to account for a large percentage of attrition and is considered the most costly in terms of lost investment by the institution, students, and grant-giving agencies, the reasons are difficult to discern. This group is the most poorly tracked and monitored. One university designates them as ETDCCs —Enrollment Terminated, Degree Candidacy Continues

For the foregoing considerations and others, the presenters at the workshop generally advocated designing research in ways that identify attrition at the various stages of the graduate education process.

Institutional Factors

Many factors impinge on student decisions whether to complete a program. Most speakers at the workshop agreed, therefore, that the raw data on the extent and timing of attrition must be supplemented with more contextual or qualitative data in order to analyze the

causes of attrition. In addition, they emphasized the need to gather this qualitative data at the institutional level. The types of information they felt would be useful would include the financial resources available for students, selection and retention policies, and the culture of departmental relationships with graduate students.

Financial aid

Although commonly believed to be a key factor in student completion, the speakers generally agreed that data on the amount of resources provided to individual students is extremely difficult to obtain. They also emphasized the importance of data on the timing and types of support available. One presenter emphasized that it was the type of support that students receive, not the amount, that is associated with differences in persistence outcomes. By becoming research or teaching assistants, she explained, students intensify their relationship with the department, which becomes a positive factor in their retention.

Illustrating the importance of timing, one participant cautioned that for students in some disciplines, a research assistantship in the early years can become a burden that substantially affects the time the student takes to complete the degree. Opinions varied at the workshop regarding the relative value of fellowships vs. teaching assistantships and research assistantships. Student responses to surveys and interviews indicate advantages and drawbacks to each. This value can also vary from discipline to discipline and from one stage of the graduate program to another.

Selection and retention

Policies for admission and evaluating students for acceptance into doctoral candidacy vary not only from institution to institution but within departments and programs at an institution.

Departments within some universities take radically different approaches on retention. One participant contrasted two successful graduate programs at the same university. One has no attrition, but is almost impossible to get into. The other has a liberal admissions policy, then tests students through their first year; those who do not master the basic skills are cut.

Departmental culture

Student perceptions of the graduate school experience are strongly influenced by their department's cultures. Unlike the case of undergraduate education, the graduate education experience is shaped by specific situations—the student's relationships with specific faculty, in some cases just one or two members of a department. Research designs, therefore, ideally should capture that complexity.

One survey (Educational Testing Service) elicited information on departmental culture in the space provided to students for open-ended comments. In other qualitative studies, specific questions have been asked about such factors as the degree of faculty mentoring, opportunities for participating in department events, student-to-student mentoring, relationships with research supervisors, and general social activities.

Current Research and Databases

The workshop featured presentations on a number of ongoing and past research projects on attrition. Both quantitative and qualitative studies were described; in some studies, both methods were employed. In the workshop, the presenters focused on the scope, methodology, and reliability of the data rather than on the findings. The projects are briefly summarized below in order of presentation at the workshop, the first three being primarily quantitative studies and the remainder, primarily qualitative.

Educational Testing Service

Begun in 1987, this longitudinal study involved a survey of an original sample of 2,500 persons who took the Graduate Record Examination (GRE) in 1986. It tracked their subsequent enrollment, asking scaled questions about degree of satisfaction with the graduate program, degree aspirations, degrees obtained, costs of education, sources and amounts of financial support, and post-graduate employment and job satisfaction. Over a ten-year period, five surveys were made of the original sample. The response rate in the last survey (1995) was 80 percent of the 2,136 test takers who returned forms in the first survey. Two difficulties the

study encountered were inaccurate reporting of financial aid and incomplete reporting and interpretation of data on students who interrupted their education, the so-called "in and out" phenomenon.

The best predictor of graduate school persistence through the fourth year of a program, the presenter said, was a student's attitude about the benefits of graduate school education. Other strong predictors were satisfaction with school progress and other students in the program, GRE scores, and self-reported undergraduate grades.

By 1995, 42 percent of the responding women and 38 percent of men reported the master's as their highest earned degree. Ten percent of the males and 6 percent of the females said they had the Ph.D., and an additional 4 percent of males and 3 percent of females claimed to be in the ABD status. In addition to the quantitative data, the survey collected individual open-ended stories that respondents were invited to write. The major shortcomings of the database are that it does not provide data for individual institutions and is minimally useful with respect to financial data, according to the presenter.

National Surveys of Recent College Graduates (NSRCG) and College Graduates (NSCG)

These surveys are conducted by the National Science Foundation's Science Resources Studies (SRS) Division. The NSRCG follows a sample of individuals who had earned the bachelor's or a higher degree as of the 1990 census. Collected every two years, the data cover about 85 percent of the population trained in science and engineering.

The NSRCG, which has the greatest potential for analyzing attrition, started with a sample of about 19,000 science and engineering (S&E) students who received their BS or MS degree in the period 1990-92. In the 1995 survey of 1993-94 graduates, the sample dropped to 16,000, but the survey followed up on about 7,000 of the 1993 interviews. The survey covers such factors as educational history, degrees, prior attendance at a community college, field and degree being worked on, and post-graduate work and its relationship to the highest degree obtained. Specific items covered that might relate to attrition include undergraduate grade-point average, loans and amounts still owed, reasons for taking courses since their last degree, and reasons for not re-enrolling.

One strength of the survey is that data on why students enter graduate school can be related to their personal history and other variables. The enrollees can then be compared with persons who decided against graduate school. Two shortcomings of the survey are that (1) it does not capture the exact timing of attrition nor the reasons for attrition and (2) it does not include data on non-S&E bachelor's degree recipients who pursue a graduate S&E degree. Some changes were underway that will improve attrition-related data in the 1997 survey.

Surveys of Earned Doctorates (SED) and Doctoral Recipients (SDR)

The SED is a survey form distributed to graduate schools to be completed by all doctoral candidates (about 40,000 annually) shortly before or at the point of degree award. The SDR is a longitudinal survey of about 50,000 persons with doctoral degrees. They are surveyed every two years until they reach the age of 76. These SRS surveys tell nothing in and of themselves about attrition, because they do not capture those who have failed to complete their degree. Combined with other data, however, they could be potentially useful for studying attrition. To date, the files have been underutilized by researchers because of confidentiality issues. Researchers who wish to use the data at their home institutions can do so, however, with proper safeguards to the confidentiality of the data. For SED data, schools have always been able to gain access to data on their own graduates.

Urban Institute-Syracuse University Project on Doctoral Student Persistence

Funded by an NSF grant, this project aims to bring out the substantial differences in the experiences of groups of doctoral students according to their program, field, and/or institution. The research focuses on underrepresented minority students, particularly Blacks and Hispanics, and on the effect of different types of financial aid on time to degree and completion rates for

doctoral degrees. It covers the same departments at two institutions in four fields: natural science, physical science, social science, and engineering. Data have been collected via semi-structured interviews and focus groups with students, faculty members, and administrators.

From responses at focus groups and interviews, the students appeared to be very dissatisfied with the amount of teaching assistantship (TA) and research assistantship (RA) support available. Subsequent inquiries revealed that the cost of living in the area had almost doubled with no concomitant increase in payments for assistantships. Students who had fellowships complained about lack of health benefits. On the other hand, these students did not feel alienated from their departments, viewing the fellowship as a stepping stone to a research assistantship. TAs complained about the amount of time expected from them, and RAs about having to focus their research too narrowly. By adding such qualitative information to the study's quantitative data, the net result is not only more reliable research, but also research better geared to the development of future policy, the presenter said.

Contextual Factors in Graduate Student Attrition

This study surveyed a sample of 816 students in the 1982 to 1984 entering cohorts in nine departments at each of two universities (selected from the top 40 Ph.D.-producing institutions in the United States). It covered both completers and non-completers. Follow-up telephone interviews were conducted with 30 of the non-completers as well as with department graduate study directors. This information was supplemented by face-to-face interviews with two faculty from each department, one who was a high producer of Ph.D.s and one who was a low producer. Rather than focusing on student characteristics, the study focused on the contextual factors in each department that shaped attrition. These involved differences between departments in terms of the opportunities they provide for integration of students into department life as measured by interaction with faculty and other graduate students on two levels—social (e.g., picnics, sports, parties) and academic (e.g., colloquia, collaboration on academic work) as well as the differences between high- and low-Ph.D. productive faculty.

The presenter described the study as highly exploratory. She found a significant correlation between the extent to which departments provide opportunities for integration and their attrition rates; and the effect was stronger and more significant when limited to opportunities for academic integration. Overall the data support the hypothesis that the more opportunities departments provide for integration (academic interaction in particular), the lower the attrition rate was in that department.

The study also assessed characteristics of faculty who are high producers of Ph.D. degrees compared to the low producers. The high-producing faculty, for example, were more likely to: scaffold their students' learning and model professional behavior by initially providing more intellectual support and withdrawing slowly as the student becomes more self-directing; co-author work with students and/or allow students to be the first author; refer to their students as friends and have their students to their homes.

The greater Ph.D.-productivity of faculty who engage in these ways with their students suggests that attrition is, in part, shaped by the type of faculty with whom a student becomes affiliated.

Urban Institute-Wake Forest: Case Studies of Black and Hispanic Doctoral Students

These studies were carried out in the 1990-91 academic year at six highly rated public institutions, focusing on three departments in each in which significant numbers of the targeted minority students were located. These included psychology and education departments in all six and a third department, including history, criminology, sociology, biology, and life sciences. The research method involved use of focus groups composed of students, faculty, department chairs, graduate school administrators, and persons specifically concerned with minority graduate student recruitment and retention. Afterwards, cross-case study analyses were conducted.

The focus group responses point to several factors related to retention, according to the presenter: the presence of minority faculty, amount and duration of

financial aid, and whether a student had a mentor or not. Mentored students seemed to have higher retention rates. The departmental differences are illustrated by the fact that retention rates for psychology departments were high at five of six institutions. In sharp contrast, only two of six education programs had high retention rates.

The study also revealed differences in student characteristics. Education students, for example, in comparison with their counterparts in the other disciplines, tended to be older, were more likely to be working while pursuing doctoral studies, and were also more likely to complain about financial aid. They also felt that white faculty had low expectations of them and that the focus of the curricula was narrowly Eurocentric.

Across the psychology departments, policies toward minority retention were more similar than they were across other departments. Psychology department faculty, for example, were usually viewed as supportive and encouraging to student study groups. In addition, a grievance mechanism was available to students, and students played active roles on departmental admissions committees. Within departments, the clinical programs tended to have more supportive environments, more positive racial climates, and more minority faculty.

Discussing minority student retention across departments, the presenter concluded that in departments that support and value all students, minority students fare equally as well as their non-minority peers.

American Institute of Physics (AIP) Survey of Physics Graduate Students

This ongoing study employs a "roster approach," gathering data on enrollments in graduate physics programs along with degrees awarded. Although AIP has collected names of graduate students in physics departments for the last 20 years or more, it has only recently begun to collect names of Ph.D. recipients. It will be a few more years, therefore, before it will be possible to determine more precisely the numbers of those who are unsuccessful in obtaining the degree. The findings of the study so far provide "very rough aggregate numbers," according to the presenter. Looking at 10 years of data on entering U.S. students, a fairly steady number—ranging from 15 to 20 percent—come out with a master's degree two years after enrollment. About 45 percent of those entering with the aim of getting a Ph.D. actually come out with the doctorate six years later.

Association of American Universities (AAU)/Association of Graduate Schools (AGS) Project for Research on Doctoral Education

Initiated in 1989, the project goal has been to develop a national longitudinal database to track the flow of students through doctoral programs in the arts, sciences, and engineering. Currently, about 40 institutions of the 61 AAU members participate. Annual data sets include basic demographic information, contextual background information, GRE scores, field of study, and financial aid data. The project is designed to provide data for departments to compare features of their programs with other programs, according to the presenter. Fields covered include biochemistry, English, economics, mathematics, chemical and mechanical engineering, history, physics, political science, and psychology.

Difficulties arise, however, in using the database to compare retention and attrition rates. These are due, for example, to variations in how institutions:

- define who is enrolled in doctoral program;
- assign student identifying numbers and how these change over time;
- record the actual start date of the graduate degree program (for example, when a student leaves and comes back, the readmission date may replace the original enrollment date);
- track what has happened to students who are not enrolled full- or part-time but who can either be making progress toward a degree, dropping out, or transferring to another department or institution; and
- report financial data.

In addition, there are sometimes data entry or information system problems, such as unexplained changes in demographic data (a male student suddenly becoming female in the fifth year of the program). All

these potential issues are confronted by researchers attempting to analyze the data, and they highlight the need for more accurate data collection.

Graduate School-Based Studies of Attrition/Retention

The focus of individual graduate school studies to date has been on completion rates not on attrition, according to a presenter who surveyed 250 graduate school administrators. The types of studies done reflect administrators' concerns with the practical issue of devising policies that can be acted upon in the near term. They include measures of completion, flow analysis studies, and comprehensive quantitative/qualitative studies. Some universities put such information on the World Wide Web. The University of Wisconsin at Madison, for instance, posts data for each department, including the size of the starting cohorts and current numbers of master's or doctorate degrees awarded. The University of Michigan site shows retention or attrition across time, revealing relatively heavy attrition early in the program and nearly zero in the out years. Examples of the comprehensive approach include the University of California at Berkeley and a Mellon Project in the Humanities. The latter covers 10 institutions and 50 departments within those institutions. Selected data presented at the workshop showed large differences in completion rates among the institutions, even within one field. In sociology, for example, it varied from a low of 38 percent to a high of 52 percent. The institutions doing the studies are also mounting efforts to enhance student participation, increase the flow to degree, and tailor financial aid to the different stages of the graduate process.

Future Directions for Research

The suggestions for future research needs that emerged can be grouped in six categories: standardizing definitions and survey instruments, conducting studies at the departmental and program level, improving data systems (particularly to capture financial information and the "in and out" students), mining of existing data bases, longitudinal studies to track student cohorts through graduate school and post-enrollment years, and qualitative studies.

Standardizing Definitions and Survey Instruments

As previously noted, institutions vary greatly in how they categorize who is a doctoral student. Thus the workshop participants were unable to arrive at a definition of this key term that would overcome the institutional and departmental differences in practice. Similarly, the issue of when to count "leavers" as an attrition statistic was not resolved.

There were, however, some suggestions on how to make attrition studies more comparable. One suggestion was to convene an expert group that would come up with a list of critical questions that everyone should ask, along with suggested ways of asking them. Another was to convene a group to devise a study model. Although the model might not be followed, it would provide a basis for comparing studies and for understanding the issues involved in attrition research.

Departmental and Program Level Studies

Perhaps the most frequently mentioned need was for more data and studies at the departmental and program level. The reasons given were as follows:

- The graduate school experience is mainly shaped at this level
- Such studies would provide meaningful data for comparative analysis
- The information is specific enough to use for changing policies and practices at the institution where the study is done

Some universities already have conducted completion or retention studies focused on departments and programs. These studies and those that extract departmental and field information from existing databases (see below, Mining Existing Databases) would facilitate cross-institutional comparisons by field.[4]

[4]For an example of such comparisons, see William G. Bowen and Neil L. Rudenstine, In Pursuit of the Ph.D, 1992 (Princeton, NJ, Princeton University Press).

Improving Data Systems

Several speakers noted that universities vary greatly in their capacity for collecting and reporting data on graduate programs. The resulting disparities create barriers to cross-cutting analyses. Some general obstacles to improving university data-gathering were mentioned, however. These include shortage of resources for information systems, the small size of most institutional research offices, and the weakly perceived need within the institution for such detailed information. In addition, initiating research at the department or program level is seen, in some cases, as risky politically.

The quality of graduate school databases may be improving, however. Some institutions were reported to be working, in some cases with outside vendors, to develop integrated institutional databases. To take advantage of this development, one speaker recommended establishing a list of common data elements needed to study doctoral persistence. One university consortium (including the Big Ten and the University of Chicago) has agreed upon eight common data elements they will collect at the program level.

Mining and Merging Existing Databases

Comparing information from one database to another has the advantage of eliminating the effort of gathering original data. One presenter described how the National Center for Education Statistics (NCES) data could be used in combination with NSF's Survey of Earned Doctorates. The NCES data on annual bachelor's degrees in science and engineering granted by U.S. institutions would be used as the denominator or universe against which awards of doctorates from NSF's SED are compared. The result would yield comparatively good estimates of the annual percentages of bachelor's degree recipients who complete science and engineering doctorates.

Another approach is to merge databases—for example, the ETS file (see page 4) with the SED. To merge the databases in this way would, however, require some adjustments to the data sets. An example would be the need to harmonize different definitions of who is enrolled and still a degree candidate.

Apart from providing a broad view, the same merged files could also be used to compare completion or attrition rates by gender or by different degree fields.

Longitudinal Studies

Studies which track a group of students over time provide advantages over the prevailing cohort or cross-sectional studies being done on graduate school attrition. What they supply that the latter type of studies do not are data that reveal the timing or sequence of events that shape key student decisions in graduate education: their plans about persisting, dropping out and returning, transferring, or abandoning pursuit of the intended degree. Longitudinal panel projects are, however, costly. Typically they require at least 10 years of coverage, with data gathered at several intervals. In order to reduce costs, research designs should target fewer fields and institutions in the sample. Rather than making sample selection a "statistical choice", the focus for policy purposes should be on institutions, departments, or programs with successful retention records.

In order to track individuals over long periods of time, particularly after they complete their course work, researchers require permanent identifiers. Much of the information needed, such as Social Security numbers (SSNs) is confidential and often not obtainable. If, however, a researcher can obtain a file containing SSNs, NSF can have the National Opinion Research Center merge the files and provide the merged data, under certain restrictions, through a licensing agreement.

Qualitative Studies

Using the qualitative method, studies would capture individual experiences in specific fields, programs, and departments. This contextualized information can then be used to promote policies that encourage persistence and equity in doctoral programs, advocates of qualitative studies argue. These studies are also costly, however, requiring labor intensive interviewing, observation, and analysis. They also encounter confidentiality issues.

Data Improvements Underway

Some of the needs and issues surrounding attrition research are already being addressed by SRS—in improvements to SRS databases and conference

activities. The sample in the Survey of Doctoral Recipients (SDR), for example, has been expanded to include all recent Ph.D.s who have received NSF fellowships. It is also being updated to include a larger number of recent Ph.D.s. The intention is to make information on the more recent doctorates available sooner for analysis. Finally, SRS is analyzing financial support by using the 1995-96 National Postsecondary Student Aid Study, which is conducted by NCES. The objectives are (1) to study the overall composition of the sources of support used by graduate students, and (2) to show how that support relates to the social and demographic characteristics of students.

SRS also held a workshop that examined the feasibility of using university accounting and financial systems to identify students by name and demographic characteristics, so that those who receive NSF support can be identified and tracked in SRS surveys.[5]

Changing the Graduate Experience

From the anecdotal evidence presented at the workshop, action to reduce attrition is not awaiting further research. Based on what is already known, universities are planning or have initiated a wide range of actions. They include modifying selection criteria, reducing time and flow to degree, enhancing student participation in department life, encouraging persistence by minorities and women, and providing incentives for faculty mentoring and productivity.

Selection criteria

As noted previously, some departmental programs screen out students vigorously after entry (sometimes referred to as "graduate hazing"); others set higher thresholds for admission and expect fewer noncompleters.

The advantages and disadvantages of each approach were debated. Converting later attrition to earlier was seen as more humane and protective of resources than waiting, as is often done, until the comprehensive exams. At the other extreme was the view that the "survival of the fittest" approach may exclude students with great potential who would benefit from a more supportive departmental culture. A third view is that either approach is valid, providing the rules are clear to students before they apply and during their studies.

Reducing time and flow to degree

Because of the varying requirements for degrees, no one suggested a uniform completion time or uniform limit after which a student no longer would be considered a doctoral degree candidate. On the other hand, institutions are looking more closely at the progress of their students. The goal is to increase the flow to degree and percentage of completers. The methods being used include monitoring student progress more regularly, establishing time norms for completion of degree requirements, and requiring faculty reviews of ABDs after a certain period. Such actions may also benefit students by keeping them better informed of their progress and keeping faculty in touch with students' plans.

In this vein, one presenter said that departments assume that graduate students understand a lot more about the structure and process of graduate education than they really do. The consequence may be a gap between departmental or institutional expectations and student expectations. To help bridge this gap, faculty and administrators could help students to develop better cognitive maps of the structure and process of the graduate programs they undertake.

Enhancing student participation in department life

Many participants emphasized the need to improve the supportive and nurturing elements of the graduate school experience. Opinions differed on the relative value of the fellowship, teaching assistantship, and research assistantship. Some students preferred being tied to a particular faculty member or research project, as is the case with TAs and RAs; others preferred the freedom to choose with whom and on what topic they choose to work, as is the case with fellows.

In describing what constitutes a supportive departmental culture, the speakers generally agreed that the key elements are the frequency and quality of faculty mentoring, student-to-student mentoring, financial aid,

[5] Report on the NSF Feasibility Workshop on Identifying and Obtaining Tracking Data for Graduate Students Supported by the National Science Foundation, June 23, 1997.

and student involvement in research. Again, the departmental and field differences, such as size of the department or the composition of its faculty by age groups and tenure status, were mentioned frequently. If a biology department, for example, has an entering cohort of 80 students and a history department with the same size faculty has 200, the environments of each are very different, one speaker noted. In comparing student responses about the relative value of the RA and TA, however, the disciplinary differences emerge clearly in one study. The students in the physical sciences felt that the RA-ship was much more helpful, whereas those in the social sciences preferred the TA-ship, the presenter commented.

Encouraging Participation and Persistence by Minorities and Women

One participant mentioned a National Research Council study[6] that included an analysis of why certain doctoral and postdoctoral programs had high completion rates for women and minorities. Based on the findings of qualitative interviews, the study identified three factors common to the successful programs: a supportive learning environment; agreement among faculty, students, and administration on the purposes of the program; and opportunity for students to become involved in the work of their fields.

Another effort to increase minority retention that was mentioned is an American Psychological Association project to create five regional centers of excellence (involving 15 institutions). These would demonstrate ways to strengthen departmental cultures to be more supportive of minority graduate students, thus reducing their attrition rate.

Other strategies and tactics for increasing the participation and the success rates for women and members of historically underrepresented groups have been discussed in other forums at NSF.[7]

[6]Educating Mathematical Scientists: Doctoral Study and the Postdoctoral Experience in the United States, National Research Council, 1992 (Washington, D.C., National Academy Press).

[7]Informal Graduate Education roundtable, September 12, 1997 and National Institute for Science Education's Strengthening Graduate Education in Science and Engineering: Promising Practices and Strategies for Implementation, June 29-30, 1998.

Incentives for Faculty Mentoring and Ph.D. Productivity

In the study, *Contextual Factors in Graduate Student Attrition* (previously described in the section, Current Research and Databases), some preliminary evidence indicated that the character of faculty-student interactions may affect persistence outcomes. The evidence suggests that high-Ph.D. productive faculty engage more frequently in certain types of academic and social interactions with graduate students.

The academic interactions by the high-productive faculty include attending colloquia, spending more hours per week interacting with students on their studies and work, seeing students in informal as well as formal settings, collaborating on academic tasks such as research papers and presentations, and co-authoring papers. The social interactions include participating in social hours, picnics, and sports, and other events outside the department, and having students to their homes.

One project to encourage more departmental attention to faculty mentoring that was mentioned is conducted by the American Sociological Association (ASA). ASA has convened its department chairs to discuss what they can do to support better faculty advising within their departments.

One observer struck a cautionary note, however, about requiring faculty to work with their students more often and to monitor their progress more closely. With their already busy schedules, they must be given incentives to devote more time to mentoring and monitoring. The message must be conveyed to them, she said, that if attrition rates remain high, faculty will not attract the best students, which would ultimately affect their ability to do research.

In considering what can be done to improve understanding of attrition, it appears that all stakeholders have an interest in the outcome of research: students, faculty, department chairs, graduate school deans and funding administrators. For this reason, one recurring suggestion was to share experiences and research related to the problem.

Stakeholder Uses of Attrition Research

A number of observations touched on the broader stake various elements of society have in attrition research.

Some specific roles for various stakeholder groups that emerged are described below.

- Graduate school administrators can develop attrition data and present it to departments as a tool for action.
- Disciplinary associations can encourage department chairs to think about their roles as important disciplinary leaders.
- Universities, in anticipation of increased pressure for accountability, can participate in the Graduation Rate Survey, a voluntary project conducted by NCES that is available on the World Wide Web. By participating, the institution can gain the statistical data necessary to create performance metrics.
- University research and planning offices can demonstrate that investment in research has major payoffs for various parts of the university.
- Education policymakers can use attrition data to make more informed decisions in allocating resources and setting graduate program goals.

Caveats About Use of Attrition Data

Although the workshop specifically focused on ways to enhance retention of students and to raise completion rates, a recurring theme was the strength of the existing higher education system. One of those strengths is its flexibility in allowing students to leave and then come back, or to transfer from one place to another. The trade-off, one participant noted, is some inefficiency. In this way, however, the system allows the students to realize the potential they have.

In a similar vein, the keynote speaker said that some promising students who do not finish the doctorate may be leaving for productive careers in new industries, such as biotechnology and computers. These sectors thus benefit from the advanced training that the students have received.

Finally, others warned against the use of attrition as the only measure of efficiency or productivity for universities. Higher rates of attrition may not necessarily reflect poor institutional performance but rather student responses to information about job markets in academia compared to opportunities elsewhere. Rather than emphasizing any one measure, educators need to look at multiple measures and how they interact.

APPENDICES

A: Workshop Speakers, Moderators, Participants, and Planners

B: Workshop Program

APPENDIX A

Workshop Speakers, Moderators, Participants, and Planners

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APPENDIX B

WORKSHOP PROGRAM

8:30 to 9:00	Breakfast and Registration
9:00 to 9:30	Welcome and Introductions Jeanne Griffith (Director, Division of Science Resources Studies, NSF) Bennett Bertenthal (Assistant Director, Directorate for Social, Behavioral, and Economic Sciences, NSF)
9:30 to 10:00	Keynote Address, Is Attrition Important, and Why? Claudia Mitchell-Kernan (UCLA)
10:00 to 10:30	Attrition: What Can We Measure? What Should We Measure? Charlotte Kuh (Office of Scientific and Engineering Personnel/ National Research Council)
10:30 to 10:45	Break
10:45 to 12:30	Uses and Limitations of Different Kinds of Databases Moderator: Alan Tupek, Deputy Division Director, Division of Science Resources Studies Vincent Tinto (Syracuse University), Contextualizing the Study of Graduate Persistence Charlotte Kuh (Office of Scientific and Engineering Personnel/ National Research Council), Administrative Databases Gita Wilder (Educational Testing Service), A Longitudinal Survey Mark Regets (Division of Science Resources Studies, NSF), Using the National Surveys of Recent College Graduates (NSRCG) & College Graduates (NSCG) to Study Graduate Student Attrition Carolyn Shettle (Division of Science Resources Studies, NSF), Using the Surveys of Earned Doctorates (SED) and Doctoral Recipients (SDR) to Study Graduate Student Attrition
12:30 to 1:15	Lunch
1:15 to 2:30	Qualitative Approaches to Studying Graduate Student Attrition Moderator: Carla Howery, American Sociological Association Toni Clewell (Urban Institute), Current NSF Project on Graduate Attrition Barbara Lovitts (University of Maryland), Contextual Factors in Graduate Student Attrition Willie Pearson, Jr. (Wake Forest University), Research on Graduate Student Attrition
2:30 to 2:45	Break
2:45 to 4:00	Professional Society Interest and Data Collection Moderator: Catherine Gaddy, Commission on Professionals in Science and Technology Michael Neuschatz (American Institute of Physics), Graduate Attrition in Physics: Some Rough Thoughts and Estimates

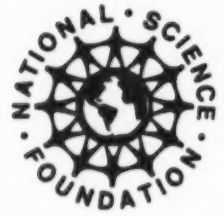
WORKSHOP PROGRAM—CONTINUED

Rocco Russo (Educational Testing Service), Research Topics addressed by the AAU/AGS Project for Research on Doctoral Education

Peter Syverson (Council of Graduate Schools), Graduate School-Based Studies of Attrition/Retention

4:00 to 5:00 — Future Directions (Group Discussion)

Moderator: Jeanne Griffith, Director, Division of Science Resources Studies, NSF



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Summary of Workshop on Graduate Student Attrition

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